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25 July 2005

Mazatlan Dolphin Moor Evaluation

OVERVIEW OF EVALUATION STUDY

The purpose of this "Letter Report" is to describe the methodology and the results obtained from the simulation-based evaluation that was conducted at the RTM STAR Center for the port of Mazatlan, Mexico. The objective of the study was to investigate the ramifications of placing a proposed passenger ship mooring platform along the main navigation channel, opposite the existing wharves. The 1-day study was performed at the RTM STAR Center in Dania Beach, Florida on 14 June 2005, and utilized the STAR Center's 360° field-of-view shiphandling simulator.

The proposed mooring arrangement consists of a central platform, and outer dolphins from which bow and stern mooring lines would be utilized to fasten the ship alongside. The use of the turning basin in this study was incidental to operations, and its evaluation for safety and maneuverability considerations was thoroughly investigated in an earlier study. The primary goal was to observe whether there were any maneuvering difficulties or safety concerns that could be attributed to the addition or location of the proposed mooring platform.
The simulated environmental conditions reflected normal daytime conditions known to exist at the Port of Mazatlan during the cruising season. Unrestricted visibility and daylight conditions were a constant. The variables included direction of transit, wind direction, wind speed, and direction of the current. The *"Carnival Conquest"* was maneuvered by a local pilot, and docking or undocking was performed without the assistance of tugboats.

PARTICIPANTS

All of the harbor transits in this study were conducted by a Mazatlan Port Pilot, with Sr. Alfonso Gil, CEO, API Mazatlan observing.

SIMULATOR CONFIGURATION

The study was conducted on RTM STAR Center's 360° (horizontal field-of-view) full-mission simulator. The simulator wheelhouse is equipped with all of the controls and displays available to the navigation team and pilot on a modern vessel, including directional control devices: helm control, engine control, water depth data, Doppler speed log, relative and true wind data,

radar, ECDIS consoles displaying navigational and geographic information about the waterway, radio communications equipment, and internal shipboard communications equipment.

The pilot/shiphandler controlled the operation of the simulated vessel during each of the exercises. He was assisted in the wheelhouse by a capable helmsman, who executed the pilot's course and rudder orders.

The STAR Center provided support staff during the conduct of simulator exercises, including a technician, and a simulator operator who initializes the systems, ensures the collection and archiving of numerical data, and generates track plots for each exercise. An observer/data collector is also provided by the STAR Center to brief the participants on the details and objectives of each exercise, to note any occurrences that might provide insights into the intentions or actions of the shiphandler, and to record the subject's verbal comments related to the simulated transits and maneuvers.

Test Vessel

The vessel of interest in this evaluation was *"Carnival Conquest"*, a conventionally-propulsed, with twin rudders and twin propellers, a passenger cruise ship with a displacement of approximately 56,000 tons. The vessel has good maneuverability characteristics utilizing the twin rudders, and the three thrusters at the bow and stern. Tug assistance while docking or undocking is not normally required. Table 1 describes vessel particulars.

Table 1 - Ship Response Model Particulars for *CARNIVAL CONQUEST*

Displace-ment Tons	Deepest Draft	Length Overall	Beam	Main Engines	Propeller Type	Thrusters
55,788	8.2 m (26.9 ft)	290.2 m (951.9 ft)	25.5 m (116.4 ft)	Diesel 42,510 hp x 2 shafts	2 variable-pitch propellers	3 bow 3 stern 2,307 hp (each)

TEST CONDITIONS

Direction of Transit

Five (5) of the simulated runs represented an arrival or docking of the cruise ship. The pilot would transit the main channel, passing the berth and turn the vessel around in the turning basin. The vessel would then dock at the mooring platform port side to, so as to be in position to proceed directly out of the port upon sailing.

Three (3) outbound transits were conducted: one (1) from the proposed mooring platform, and two (2) from the wharf on the opposite side of the navigation channel, where cruise ships are frequently docked. Runs commencing at the passenger ship wharf were included to examine the effect, if any, of the mooring platform, with a vessel tied alongside, upon transiting vessels proceeding to or from the main wharf berths.

Additionally, departures from the passenger ship wharf were performed to evaluate the amount of maneuvering room available, and the degree of difficulty in transiting outbound from the port with vessels at both the new platform, and at the wharf opposite (across the main channel). While this situation is not envisioned as a likely scenario, it was deemed advisable to examine the possibility. The resulting constriction of the navigation channel by large passenger vessels moored on both sides, must be considered in any examination of port safety.

Wind and Tide

Wind conditions at the Port of Mazatlan were reported by the pilot and port representative as being light to moderate during the cruising season; generally 10 knots of wind or less. Based on their input the harbor transits were performed with winds from the West, Northwest and the East directions. Due to the limited time constraints for the project, it was decided that higher wind speeds would be used in simulation, representing conditions that would prove challenging for as the shiphandler, yet fall within a realistic range. Wind speeds of 15 and 20 knots were simulated.

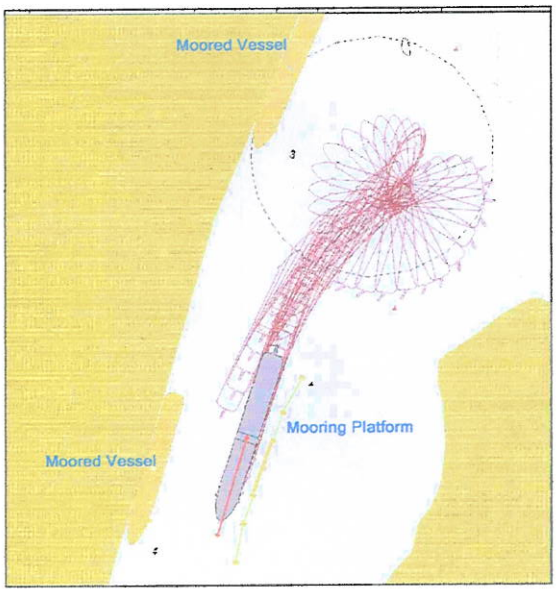
Both flood and ebb tidal currents were simulated. Ebb currents of 1 to 1.3 knots and flood currents of 1 knot were considered representative.

RESULTS

The first simulator run is generally used to provide familiarization to the shiphandler with the port's visual database and the ship's controls in the simulator wheelhouse. Therefore, for the initial inbound transit, no wind or tidal current was simulated. Wind forces and/or tidal currents were applied in subsequent runs.

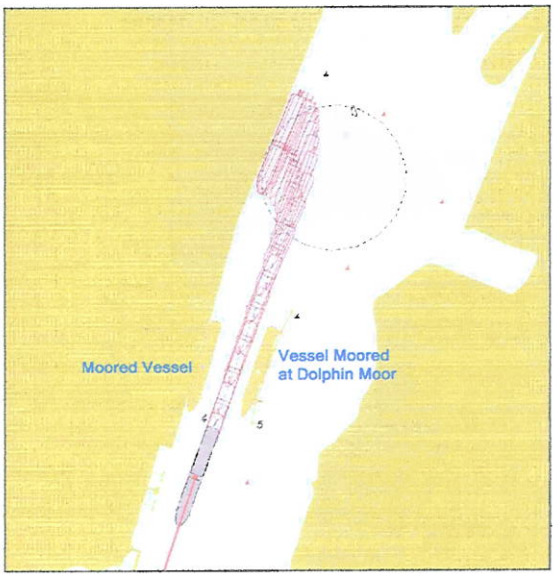
Inbound Transits

The standard arrival strategy, as mentioned earlier, and weather permitting, is to proceed inbound, passing the designated berth to the turning basin, where, the vessel is turned to head outbound, prepared for departure. This strategy is exemplified by the following track plot, where the vessel , after turning, is docked at the dolphin moor, while the main wharf is occupied by another vessel. This maneuver was performed with a Northwest wind of 20 knots.



Outbound Transits

Departures from the dolphin moor with no vessels moored at the opposite dock, were not extensively simulated because of their straight-forward procedures, requiring the vessel to simply breast off the moor, and proceed out of the channel. Departures that required *"Carnival Conquest"* passing between two moored passenger ships (one at the wharf and one at the proposed mooring platform) were examined, and successfully completed with a usable channel width of approximately 100 meters. This test is depicted in the following representation, and was performed with wind from the West at 15 knots.



SUMMARY OF FINDINGS & RECOMMENDATIONS

Berthing Strategy

Recommendations are the result of both the pilot's final commentary, and the observed results of this simulation. No recommendations are made with respect to the turning basin. This was the subject of an earlier study and no problems or incidents in this study can be attributed to its design or dimensions.

The impact of the proposed mooring platform on the edge of the navigation channel at Mazatlan will be most noticeable for vessels transiting the port while a vessel is moored either at the wharf opposite the proposed berth, or at the dolphin moor itself. The most severe impact will occur if large vessels are berthed at both locations simultaneously, causing constriction of the channel. The necessity of maintaining steerageway while passing through this channel constriction during moderate to severe wind conditions, could necessitate a greater transit speed, causing surge[1] problems to one or both of the moored vessels. Because surge effects can strain mooring lines, and if the resulting movement is severe, may cause injuries to passengers and crew embarking or disembarking at the gangway, it is recommended that passenger cruise ships or other large vessels, not be permitted to transit the navigation channel in either direction, if or when, this situation arises.

Platform Design

The participating pilot recommends/suggests that vessel mooring lines, while at the new platform, should have a lead of 35 to 40 meters, which would require that the outer dolphins be set at a greater distance from the main platform. The current tested design calls for an overall length of 334m between the outer dolphins. *"Carnival Conquest"*, whose length is 290 meters, would require the outer dolphins spacing to be 370 meters if the pilots recommendation is implemented. Adding this additional length to the overall platform should be considered, and is recommended.

Regardless of procedures put in place to limit the circumstances of having ships passing between two moored vessels, it is highly likely that such a situation can occur at some future point. With this situation in mind, the pilot recommended that the platform be recessed further from the edge of the navigation channel to provide a greater width when vessels are berthed at either the new mooring platform or at the wharf opposite this site. A greater width will lessen the likelihood of surge effects on moored vessels, and provide better maneuver room for passing vessels.

Although simulation has proven that a mooring platform, in the position tested, is an acceptable solution for added mooring capacity at the port, and does allow safe transits for vessels, repositioning the platform further to the East should be considered. This repositioning, while entailing additional dredging, would widen the navigable channel and provide a greater margin of safety. A slight repositioning to the East is recommended.

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[1] Movement of a vessel caused possibly by the close proximity of another passing vessel.